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## PATENT ABSTRACTS OF JAPAN

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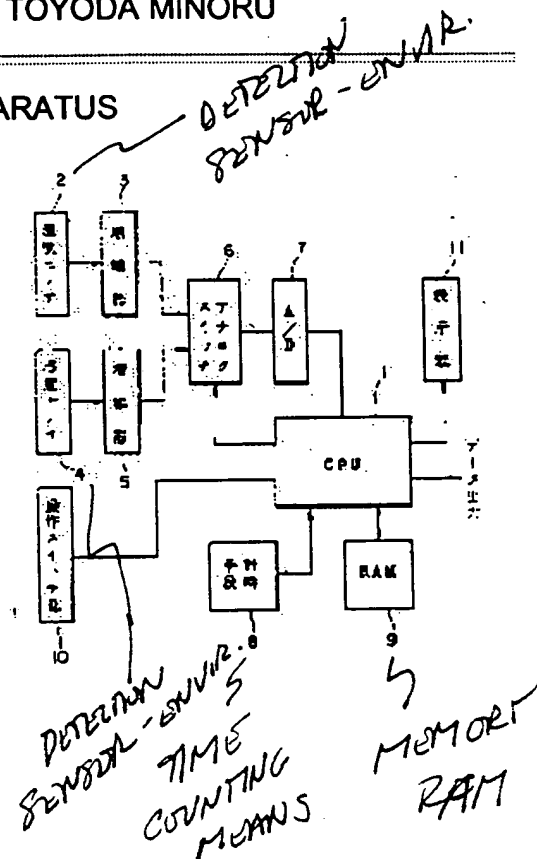
## (54) ENVIRONMENTAL CONDITION MEASURING APPARATUS

## (57)Abstract:

PURPOSE: To enable unmanned measurement of secular changes in environmental conditions, by providing a detection sensor for environmental conditions and a time counting means to enable the output of the sensor to be outputted to an external recorder once memorized into a memory as associated with the time.

CONSTITUTION: Various detection sensors 2 and 4 for detecting environmental conditions such as temperature and humidity and a time counting means 8 are provided and detection data outputted from the detection sensors 2 and 4 are memorized into a memory (RAM)9 comprising an integrated circuit as associated with time data outputted from the time counting means 8. In this

apparatus containing no recording means, after the end of measurement, based on a command, the memory contents of the RAM9 are read out with a CPU1, which can output data to a recorder connected externally. Thus, changes in the environment such as encountered by article in the distribution process can be measured automatically.



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⑭ 発明の名称 環境条件計測装置

⑮ 特 願 昭59-190463

⑯ 出 願 昭59(1984)9月13日

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## 明 細 書

## 1. 発明の名称

環境条件計測装置

## 2. 特許請求の範囲

環境条件を検出するセンサと、集積回路からなるメモリと、計時手段と、前記センサから出力される環境条件のデータと前記計時手段から出力される時間とを互に関連付けて前記メモリに書き込む制御装置とを有してなり、記録手段は内蔵せず、かつ前記メモリに書き込まれた前記環境条件のデータおよび前記時間を外部記録装置に出力可能であることを特徴とする環境条件計測装置。

## 3. 発明の詳細な説明

(産業上の利用分野)

本発明は、物品がその流通過程において受ける環境条件の変化、あるいはその他の環境条件の変化を計測し、それを時間と関連付けて記憶する環境条件計測装置に関する。

(従来の技術)

従来より、温度、湿度等の環境条件の変化を計

測し、それを時間に対応させて記録する計測装置は種々存在していた。

しかしながら、従来のこの種の計測装置は、もっぱら室内等において静置状態で使用されることを前提とした構造となっていた。

(発明が解決しようとする問題点)

物品がその流通過程において受ける温度、湿度等の環境条件の変化を計測・記録することは、物品の品質管理等の上で非常に重要な項目である。

しかしながら、従来は、前述のように環境条件を計測・記録する計測装置がもっぱら室内等において静置状態で使用されることを前提とした構造となっていたので、

(a) 物品の流通過程において作用する振動、衝撃等の外力に計測装置が耐えられない。

(b) 計測装置に必要な電源の確保が困難である。

等の関係から、物品が流通過程において受ける環境条件の変化を、その物品の発送から目的地に到着までの間の全過程を通じ一貫して計測・記録す

ることは不可能であった。

このため、従来は、流通過程中の限定された場所でのみ、環境条件の計測を実施しているに過ぎないのが実情であり、しかもこの計測には、計測装置を操作する人員が必要であるという問題点があった。

#### (発明の目的)

本発明は、前記従来の問題点を解決するためになされたもので、物品がその流通過程において受ける環境条件の変化、あるいはその他の環境条件の変化を無人で長時間計測し、かつそのデータを時間と関連付けて記憶し、計測終了後は室内にて、記憶した環境条件のデータおよびこれに対応する時間を外部記録装置に出力し、該外部記録装置に前記環境条件のデータを時間と関連付けて記録させることができる環境条件計測装置を提供することを目的とする。

#### (問題点を解決するための手段)

本発明による環境条件計測装置は、環境条件を検出するセンサと、集積回路からなるメモリと、

計時手段と、前記センサから出力される環境条件のデータと前記計時手段から出力される時間とを互に関連付けて前記メモリに書き込む制御装置とを有してなり、記録手段は内蔵せず、かつ前記メモリに書き込まれた前記環境条件のデータおよび前記時間を外部記録装置に出力可能なものである。

#### (作用)

本発明においては、集積回路からなるメモリに、環境条件のデータとこのデータに対応する時間とが互に関連付けて記憶され、計測終了後、前記メモリに記憶されている環境条件のデータおよび時間を外部記録装置に出力し、該外部記録装置に環境条件のデータを時間と関連付けて記録させることができる。

#### (実施例)

以下、本発明の実施例を図面に基づいて説明する。

第1図は本発明の一実施例を示す。この実施例において、1はマイクロプロセッサ等からなる中

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央処理装置(以下、CPUと略記する)、2は温度センサ、3は温度センサ2の出力を増幅する増幅器、4は湿度センサ、5は湿度センサ4の出力を増幅する増幅器である。

6はアナログスイッチであり、CPU1の制御の下で、増幅器3、5の出力を時分割でA/D変換器7に入力する。8はクロックジェネレータおよびカウンタからなる計時手段、9は集積回路からなるランダム・アクセス・メモリ(以下、RAMと略記する)、10は操作スイッチ部、11は液晶ディスプレイ等からなる表示装置である。

そして、以上の回路構成要素1~11は、図示しない電池をその電源として動作するようにされている。

流通過程において物品が受ける環境条件の変化を本計測装置によって計測したい場合には、流通経路において、計測対象となる物品に本計測装置を随伴させる。これにより、流通経路における前記物品の環境温度および湿度はそれぞれ温度センサ2、湿度センサ4によって検出される。

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なお、ここにおいて、本計測装置は、後述するように集積回路からなるRAM9をデータの記憶媒体としており、かつ記録手段を有しないので、振動、衝撃等の外力に耐えることができるとともに、前記のように電池を電源とすることが可能であり、外部電源を必要としないため、流通経路において、計測対象となる物品に本計測装置を容易に随伴させることができる。

そして、上述のようにして温度センサ2によって検出された温度は増幅器3によって増幅された後、また、湿度センサ4によって検出された湿度は増幅器5によって増幅された後、それぞれアナログスイッチ6を介してA/D変換器7に入力され、該A/D変換器7でディジタル値に変換される。

また、CPU1は、上述のようにしてA/D変換器7の出力に得られるディジタル化された温度および湿度のデータを、必要に応じた時間間隔で間欠的に取り込み、RAM9に書き込むとともに、表示装置11に表示させる。

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ここで、温度および湿度は一般に急激に変動することはないので、本実施例では、前記データの取り込みは、1分間、5分間、および10分間の3種類の時間間隔で行えるものとし、このうちのいずれの時間間隔で実際にデータの取り込みを行うかは、あらかじめ操作スイッチ部10により指定しておくものとする。

また、CPU1は、上述の温度および湿度のデータの取り込みと同時に、その時刻をも計時手段8から取り込み、前記温度および湿度のデータと関連付けてRAM9に書き込む。

以上の結果、本計測装置においては、物品が流通過程において受ける環境条件の変化を、無人で長時間計測・記憶することができる。そして、計測対象となる物品が流通過程の終点に達し、計測が終了したならば、室内にて、本計測装置を外部装置と接続し、RAM9から温度および湿度のデータを時刻とともに読み出し、外部装置に温度および湿度を時間軸に沿って記録させることができる。

第2図は上述の外部装置の一例を示す。12はマイクロプロセッサ等からなるCPU、13はこのCPU12と前記計測装置のCPU1との間に挿入されるデータ入力インターフェース、14は操作スイッチ部、15はX-Yプロッタ、16はCPU12とX-Yプロッタ15との間に挿入されたデータ出力インターフェースである。

前記計測装置のCPU1によって前記計測装置のRAM9から読み出された温度、湿度および時刻のデータは、インターフェース13を介してこの外部装置のCPU12にシリアルに入力される。そして、該CPU12は、これらのデータをインターフェース16を介してX-Yプロッタ15にパラレルに出力し、該プロッタ16に温度-時間および湿度-時間の波型として記録させる。

なお、これまで、物品がその流通過程において受ける環境条件の変化を計測する場合に関してのみ本発明を説明したが、本発明は、それ以外の環境条件、例えば、航空機、船舶、車両等の輸送機関において乗客が受ける環境条件の変化等を計測

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する計測装置にも適用できるものである。

(発明の効果)

以上のように本発明による環境条件計測装置は、物品がその流通過程において受ける環境条件の変化、その他の環境条件の変化を、無人で長時間計測し、かつそのデータを時間と関連付けて記憶し、計測終了後、室内にて、記憶している環境条件のデータおよびこれに対応する時間を外部記録装置に出力し、該外部記録装置に前記環境条件のデータを時間と関連付けて記録させることができるという優れた効果を奏されるものである。

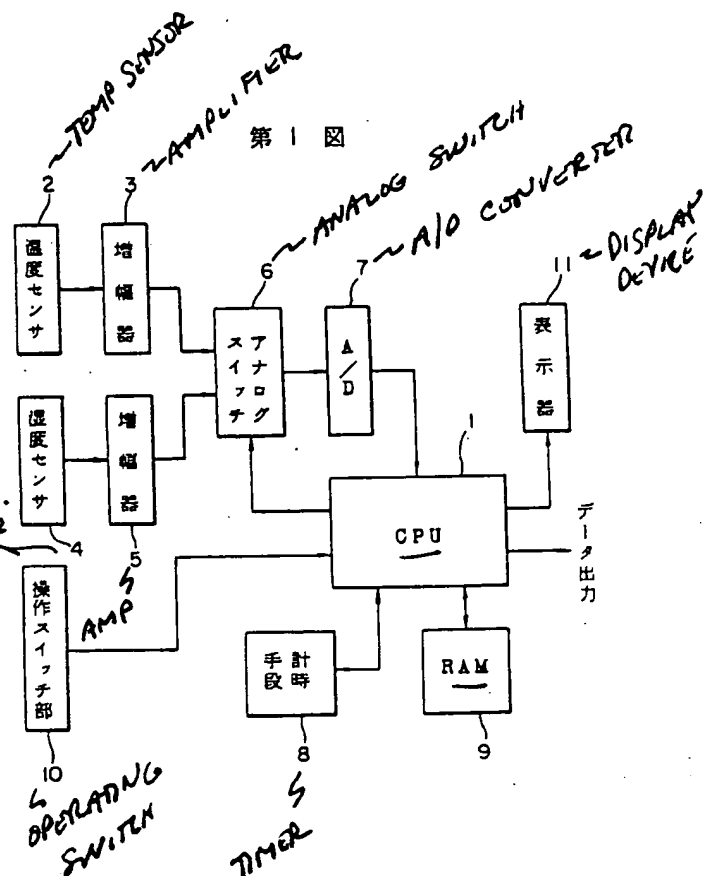
#### 4. 図面の簡単な説明

第1図は本発明による環境条件計測装置の一実施例を示すブロック図、第2図は本発明による環境条件計測装置によって計測・記憶された環境条件のデータを記録するための外部装置の一例を示すブロック図である。

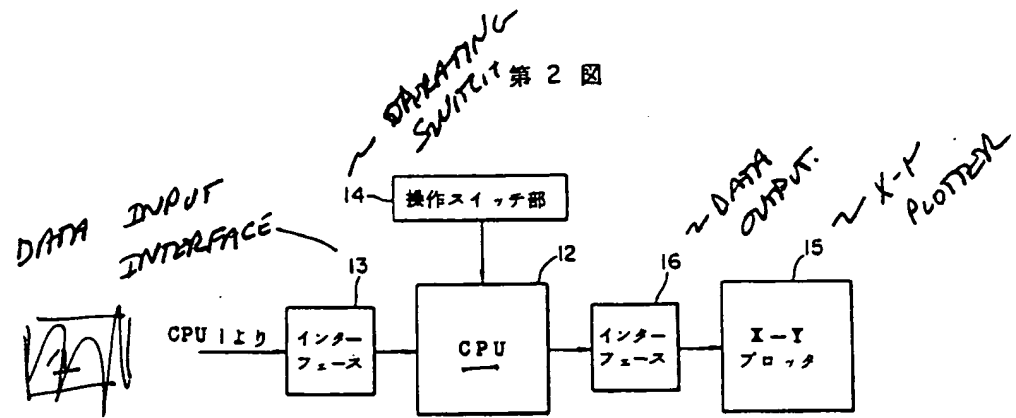
1…CPU、2…温度センサ、3…湿度センサ、8…計時手段、9…RAM、16…X-Yプロッタ。

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(51) Int. Cl. <sup>4</sup>	Identification Code	File Number	(43) Publication Date: April 8, 1986
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(54) Title of the Invention: Device for measuring environmental conditions

(21) Patent Application: S59-190463

(22) Application Date: September 13, 1984

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## Specification

### 1. Title of the Invention:

Device for measuring environmental conditions

### 2. Claim(s):

A device for measuring environmental conditions that has an environmental condition detection sensor, a memory comprising an integrated circuit, a timer means, and a control device that defines the relationship between the data on environmental conditions outputted by said sensor and the timing outputted by said timer means, and that writes the same to said memory, wherein a recording means is not equipped internally, and wherein it is possible to output the said data on environmental conditions and said times which have been written to said memory to an external recording device.

### 3. Detailed Explanation of the Invention

#### (Area of Industrial Application)

The present invention relates to devices for measuring environmental conditions that measure changes in environment conditions experienced by products during the distribution process thereof, or other changes in environment conditions, and that store the results of those measurements along with the associated times.

(Prior Part)

Conventionally, there have been a variety of measuring devices that measure changes in environment conditions such as temperature and humidity and that correlate said changes with the timing thereof.

However, the structures of these types of conventional devices have been based on the premise that said devices would be used in a resting state inside a room.

(Problem(s) to be Solved by the Present Invention)

The measurement and recording of changes in environmental conditions such as temperature, humidity, and the like, experienced by products during the product distribution process is an extremely important issue in product quality management.

However, conventionally, as described above, all of the measurement equipment that measures and records in environmental conditions have had structures built on the premise that they will be used in the resting state indoors, so it has not been possible to consistently measure and record the changes in environmental conditions experienced by a product throughout the entire product distribution process, from the time the product is shipped out until it reaches its destination, for reasons such as:

- (a) The measurement equipment being unable to withstand such external forces as vibrations and shocks exerted upon it during the product distribution process, and
- (b) Difficulty in securing the power supply required by the equipment.  
Because of this, there have been \ problems in the past in that actual environmental conditions were nothing more than conditions that had been measured only at limited locations during the distribution process, and that the measurements had required personnel to operate the measurement devices.

(Object of the Invention)

The object of the present invention is to provide a device for measuring environmental conditions that solves the aforementioned problems in prior art by measuring changes in the environmental conditions experienced by products during the product distribution process, or measuring other environment conditions over extended periods of time in a manner that does not require human operation, storing the data after associating it with the times it was recorded, and outputting the results to an external recording device in an office or laboratory after the measurements have been completed, recording the environmental data that has been stored along with the associated timing data, thus making it possible to record the relationships between said data on environmental conditions and the timing thereof in the said external recording device.

(Means of Solving the Problem(s))

The device for measuring environmental conditions set forth in the present invention has an environmental condition detection sensor, a memory comprising an integrated circuit, a timer means, and a control device that defines the relationship between the data on environmental conditions outputted by said sensor and the timing outputted by said timer means, and writes the same to said memory, wherein a recording means is not equipped internally, and with which it is



possible to output to an external recording device the said data on environmental conditions and said times that have been written to said memory.

#### (Operation)

In the present invention, the data on environmental conditions and the times associated with said data are linked to each other and stored in a memory made from an integrated circuit, where, after the measurements have been completed, it is possible to output to the data on environmental conditions and the timing [thereof], stored in a memory, to an external recording device, making it possible to record to said external recording device the relationship between the data on environmental conditions and the timing thereof.

#### (Example Embodiments)

Example embodiments of the present invention will be explained below, based on the drawings.

Figure 1 illustrates an example embodiment of the present invention. In this example embodiment, No. 1 is a central processor unit (hereinafter abbreviated "CPU") comprising a microprocessor. No. 2 is a temperature sensor. No. 3 is an amplifier that amplifies the output from the temperature sensor 2. No. 4 is a humidity sensor, and No. 5 is an amplifier that amplifies the output from the humidity sensor 4.

No. 6 is an analog switch that, under the control of the CPU 1, inputs the outputs of the amplifiers 3 and 5 into an A/D converter 7, using time-domain multiplexing. No. 8 is a timer means comprising a clock generator and a counter. No. 9 is a random access memory (hereinafter abbreviated "RAM") comprising an integrated circuit. No. 10 is an operating switch unit. No. 11 is a display device made consisting of a liquid crystal display.

The circuit elements 1 through 11, described above, operate on the basis of power supplied from batteries, which are not shown.

In order to use the present measurement device to measure the changes in environment conditions experienced by products during the distribution process, the measurement device is caused to accompany the product for which the measurements are to be performed. Consequently, the temperatures and humidity in the environment of said product during the distribution process will be detected by the temperature sensor 2 and the humidity sensor 4, respectively.

It should be noted at this point that the measurement device uses the RAM 9, comprising an integrated circuit, as described below, as the memory medium, and it has no recording means, so not only is the device able to withstand external forces such as vibrations and shocks, but, as described above, the device can use batteries as its power supply, and because it thus does not require an external power source, the measurement device easily can accompany the product for which the measurements are to be made.

Given this, the temperatures sensed by the temperature sensor 2, as described above, are amplified by the amplifier 3, and the humidities detected by the humidity sensor 4 are amplified by the amplifier 5, after which each are inputted into the A/D converter 7 through an analog switch 6, to be converted into digital values by said A/D converter 7.

Furthermore, the CPU 1 reads in, at the required intervals, the digital temperature and humidity data obtained in the output of the A/D converter 7, as described above, not only writing it to the RAM 9 but also displaying it on a display device 11.

At this point, because there are typically no rapid changes in temperature or humidity, in the present invention the said reading-in of data is performed at three different time intervals: once each minute, once every five minutes, and once every 10 minutes. The actual timing interval for reading in the data is specified in advance using the operating switch unit 10.

The CPU 1 reads in time stamps from the timer means at the same time it reads in the aforementioned temperature and humidity data, correlating said time stamps to said temperature and humidity data, and writing the results to the RAM 9.

The result of the above is that, in the present measurement device, changes in environmental conditions experienced by the product during distribution can be measured and stored over extended periods of time without requiring human operation. Furthermore, if a measurement has been completed by the time the product for which the measurement has been performed arrives at the end of the distribution process, then the measurement device can be connected to an external device in an office, laboratory, or the like, to read the temperature and humidity data, along with the time stamps from the RAM 9, making it possible to record the temperature and humidity in an external device as a function of time.

Figure 2 shows an example of the external device described above. No. 12 is a CPU, such as a microprocessor. No. 13 is a data-input interface inserted between this CPU 12 and the aforementioned measurement device 1. No. 14 is an operating switch unit. No. 15 is an X-Y plotter. No. 16 is a data output interface inserted between the CPU 12 and the X-Y plotter 15.

The temperature, humidity, and timestamp data read out from the RAM 9 of the aforementioned measurement device by the CPU 1 of the aforementioned measurement device are outputted serially through the interface 13 to the CPU 12 of the external device. Said CPU 12 outputs this data through a parallel interface 16 to the X-Y plotter 15, where the temperature-time and humidity-time waveforms are recorded on said plotter 16.

Although the present invention has so far been explained only with respect to cases in which changes in environmental conditions experienced by a product in the distribution process are measured, the present invention can also be applied appropriately to measurement devices that measure changes in the environment conditions experienced by passengers in airplanes, ships, automobiles, and other vehicles.

#### (Effect(s) of the Invention)

The device for measuring environmental conditions set forth in the present invention, as described above, is able to measure changes in the environmental conditions experienced by a product during the distribution process, or changes in the other environment conditions, over extended periods of time without requiring human attendance, and is able to store the data and the associated timing thereof so that, after the measurements have been completed, the stored data on environmental conditions and the timing associated therewith can be outputted to an external recording device, making it possible to record, in the external recording device, the

relationship between the data for said environment conditions and the timing thereof, thus producing a superior effect.

#### 4. Brief Explanation of the Drawings

Figure 1 is a block diagram illustrating an example embodiment of the device for measuring environmental conditions set forth in the present invention.

Figure 2 is a block diagram showing an example of an external device for recording the data on environmental conditions that has been measured and stored in memory by the device for measuring environmental conditions set forth in the present invention.

- 1: CPU
- 2: Temperature Sensor
- 3: Humidity Sensor
- 8: Timer Means
- 9: RAM
- 16: X-Y plotter

#### Figure 1

[see original for figure]

- 2: Temperature Sensor
- 3: Amplifier
- 4: Humidity Sensor
- 5: Amplifier
- 10: Operating Switch Unit
- 6: Analog Switch
- 8: Timer Means
- 11: Display Device

[text to the right of and below No. 11]: data output

#### Figure 2

[see original for figure]

[on left]... from the CPU 1

- 14: Operating Switch Unit
- 13: Interface
- 16: Interface
- 15: X-Y Plotter